Could Chemical Seed Treatments Limit the Spread of *Fusarium graminearum* Through Infected Seed?

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Introduction

Fusarium head blight (FHB) has been causing losses to the grain industry in eastern regions of the Canadian Prairies. Its potential spread further westward is of major concern to wheat and barley growers. Planting *Fusarium*-infected seed may introduce *F. graminearum* into areas that for the most part are still free of FHB. This pathogen could become established in plant tissue as a root/crown pathogen or as a saprophyte and produce inoculum which could then cause head infections of subsequently-grown cereal crops.

Until more resistant cereal varieties are developed, it is important to reduce the potential impact of FHB by slowing down its introduction to western Saskatchewan and Alberta. It is therefore of interest to determine the effectiveness of seed treatments in preventing the spread of *F. graminearum* which could result from planting an infected seed lot. This will assist with the development of strategies to prevent or restrict the movement of this pathogen into areas where it is still rare or absent.

Materials and Methods

In 2003 and 2004, *F. graminearum*-infected seed of barley (2004 only), and common and durum wheat treated with fungicides currently registered in Canada (Charter 2.5, Dividend XL, Raxil 250, Vitaflo 280 and Maxim) were planted in replicated trials at two locations in southern Saskatchewan, Indian Head and Halford. Seed were treated with these products at recommended rates. Controls consisted of untreated *Fusarium*-infected seed and seed from an uninfected lot, which was used to differentiate between seed-borne and soil-borne fungal infections.

At stem elongation, 50-75 plants from one row in each plot were carefully removed, and subcrown internodes (SI) rated for extent of brown to black discoloration (slight=1 to 25%,

moderate=25 to 50%, and severe=>50% discoloration). Percent of SI with severe, and moderate or severe, discoloration was then calculated. A piece of each discolored SI (1-2 cm) was surface-disinfested, and plated on nutrient agar for fungal identification. Percent isolation of each fungus was calculated based on the total number of fungal isolations in each plot. All percentage data were arcsine-transformed, and analyzed by ANOVA.

Results

SI discoloration

In most cases, the untreated uninfected control had a lower level of SI discoloration than the untreated infected control, even though this difference was not always statistically significant (Table 1). At Indian Head in both years, all seed treatments had a lower percentage of SI with 'moderate or severe' discoloration than the untreated infected control. However, in most cases at Halford there were no significant differences in SI discoloration between chemical seed treatments and the untreated infected control.

Fusarium populations in SI

Fusarium graminearum was recovered from discolored SI in all treatments (Table 2). In addition, percent isolation of *F. graminearum* and other *Fusarium* spp. from seed-treated plots was generally not significantly different from that in the untreated infected control. In both years and locations, there were lower levels of *C. sativus* in the Dividend XL treatment than in any other treatment.

The absence, or very low levels, of *F. graminearum* in the untreated uninfected control verified that the presence of this pathogen in the other treatments resulted from seed-borne infections. However, due to variability among reps in percent fungal isolation this difference was not always statistically significant. The similar percent isolation of *F. avenaceum* and *C. sativus* from the infected and uninfected controls suggests that SI infections by these fungi were primarily soil-borne.

Conclusions

Differences in SI discoloration between the untreated infected control and chemical seed treatments were not consistent among years or locations. No seed treatment resulted in a consistently lower level of SI discoloration at both locations and years.

None of the products tested appeared to prevent or consistently reduce the growth of *F. graminearum* from infected barley, and common and durum wheat seed into SI tissue.

Based on these observations, we conclude that treating *F. graminearum*-infected seed with currently registered fungicides will not likely prevent the spread of this pathogen into areas still

relatively free of FHB. Thus, cereal producers in western regions of the Canadian Prairies should be strongly encouraged to test their seed lots for the presence of *F. graminearum*, and to plant only uninfected seed.

Table 1. The effect of chemical treatment of *Fusarium*-infected barley, common and durum wheat seed on subcrown internode discoloration, at Indian Head and Halford, Saskatchewan in 2003-2004.

	Indian Head 2003		Halford 2003		Indian Head 2004		Halford 2004	
	S[1]	M/S	S	M/S	S	M/S	S	M/S
	%							
Untreated infected	7.9 a[2]	23.1 a	4.5 ab	13.7 ab	7.9 a	14.9 a	7.9 a	11.4 a
Untreated uninfected	2.0 b	9.1 d	2.3 b	9.8 b	3.4 a	8.0 abc	2.2 b	5.7 a
Raxil 250	4.8 ab	11.3 cd	3.4 ab	11.2 ab	3.7 a	9.1 ab	4.1 ab	7.5 a
Vitaflo 280	5.2 ab	12.2 cd	4.0 ab	10.3 ab	2.9 a	5.9 c	5.3 ab	9.3 a
Charter 2.5	7.0 a	15.9 bc	4.8 a	14.8 a	5.5 a	10.7 ab	6.0 a	10.3 a
Dividend XL	6.4 a	15.4 bc	3.3 ab	11.0 ab	2.2 a	5.0 c	2.5 b	6.3 a
Maxim	-	-	-	-	2.7 a	6.5 bc	2.4 b	6.1 a

[1] S= severe, percent subcrown internodes with >50% of area discolored; M/S= moderate/severe: percent subcrown internodes with >25% of area discolored.
[2] Mean percent isolation values across treatments followed by the same letter are not significantly different at P≤0.05, according to LSD test.

Table 2. The effect of chemical treatment of *Fusarium*-infected barley, common and durum wheat seed on the percent isolation of fungi from subcrown internodes, at Indian Head and Halford, Saskatchewan in 2003-2004.

	F. graminearum	*F. avenaceum*	Total *Fusarium*.spp.	*Cochliobolus sativus*
	---------- % ----------			
Indian Head 2003				
Untreated infected	20.8 a[1]	1.4 a	61.5 ab	12.8 a
Untreated uninfec	0.0 b	3.8 a	52.5 b	12.6 ab
Raxil 250	19.4 a	2.0 a	51.3 b	7.6 ab
Vitaflo 280	25.7 a	1.7 a	61.1 ab	6.5 ab
Charter 2.5	26.9 a	3.5 a	65.6 a	5.9 b
Dividend XL	24.7 a	2.7 a	70.6 a	0.0 c
Halford 2003				
Untreated infected	11.7 b	6.9 a	51.4 ab	26.1 a
Untreated uninfected	0.0 c	5.4 a	52.0 ab	29.8 a
Raxil 250	18.6 ab	9.5 a	46.6 b	20.3 a
Vitaflo 280	24.9 a	6.3 a	57.9 ab	17.9 a
Charter 2.5	16.4 ab	3.8 a	43.6 b	21.0 a
Dividend XL	22.9 a	2.4 a	63.5 a	1.3 b
Indian Head 2004				
Untreated infected	5.0 a	0.9 a	27.9 a	44.9 ab
Untreated uninfected	0.4 a	2.6 a	24.3 a	36.4 b
Raxil 250	7.8 a	0.0 a	16.8 a	41.2 ab
Vitaflo 280	4.9 a	0.9 a	17.2 a	44.3 ab
Charter 2.5	5.0 a	0.0 a	21.7 a	38.9 ab
Dividend XL	6.5 a	1.4 a	23.1 a	12.6 c
Maxim	2.6 a	0.0 a	10.7 a	50.3 a
Halford 2004				
Untreated infected	0.8 a	0.5 a	22.1 ab	40.1 a
Untreated uninfected	0.0 a	0.0 a	9.3 b	23.6 ab
Raxil 250	0.0 a	1.4 a	15.0 b	34.5 a
Vitaflo 280	0.0 a	5.8 a	27.0 ab	30.4 a
Charter 2.5	2.6 a	4.2 a	13.6 b	33.2 a
Dividend XL	1.7 a	3.3 a	39.6 a	7.9 b
Maxim	0.0 a	3.0 a	20.7 b	37.9 a

[1]Mean percent isolation values across treatments followed by the same letter are not significantly

different at P≤0.05, according to LSD test.

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